CLAIMS

What is claimed is:

1. A tool **(20)** for impacting a workpiece **(22)**, comprising;

a casing **(42)** having a proximal end **(44)** and a distal end **(46)** and defining a chamber **(48)** therebetween,

an impactor device **(24, 54)** slidable within said chamber **(48)** along an operational axis **(A)** to impact the workpiece,

a valve system **(100, 200)** for selectively introducing and releasing pressurized fluid into and out from said chamber **(48)** to slide said impactor device **(24, 54)** within said chamber **(48)** along said operational axis **(A)**, and

an energy absorbing mechanism **(402)** including a sleeve **(404)** slidable along said distal end **(46)** of said casing **(42)** to define a first pressure chamber **(412)** with said impactor device **(24, 54)** for reducing the kinetic energy of said impactor device **(24, 54)** in a first stage immediately after movement thereof by compressing pressurized fluid within said first pressure chamber **(412)**,

said tool **(20)** characterized by said energy absorbing mechanism **(402)** further comprising a second pressure chamber **(414)** defined between said casing **(42)** and said sleeve **(404)** for reducing the kinetic energy of said impactor device **(24, 54)** in a second stage by compressing pressurized fluid within said second pressure chamber **(414)** after compressing the pressurized fluid in said first pressure chamber **(412)** when said impactor device **(24, 54)** impacts said sleeve **(404)**.

2. A tool as set forth in claim 1 wherein said sleeve **(404)** includes a first annular wall **(406)** and a second annular wall **(408)** coaxial with and surrounding said first annular wall **(406)** with an annular groove defined therebetween and said casing **(42)** is slidable within said annular groove.

3. A tool as set forth in claim 2 wherein said first pressure chamber **(412)** is defined between said first annular wall **(406)** and said impactor device **(24, 54)** and said second pressure chamber **(414)** is defined between said casing **(42)** and said second annular wall **(408)** and said first pressure chamber **(412)** is radially offset from said second pressure chamber **(414)** relative to said operational axis **(A)**.

4. A tool as set forth in claim 1 wherein said impactor device **(24, 54)** comprises a tool bit **(24)** and a piston **(54)** independent and separable from said tool bit **(24)** whereby said piston **(54)** slides within said chamber **(48)** upon actuation of said valve system **(100, 200)** to impact said tool bit **(24)** and drive said tool bit **(24)** into the workpiece **(22)** and said first pressure chamber **(412)** reduces the kinetic energy of said tool bit **(24)** after impact by said piston **(54)** by compressing pressurized fluid within said first pressure chamber **(412)** and said second pressure chamber **(414)** reduces the kinetic energy of said tool bit **(24)** after compressing the pressurized fluid in said first pressure chamber **(412)** when said tool bit **(24)** impacts said sleeve **(404)**.

5. A tool as set forth in claim 1 wherein said first **(412)** and second **(414)** pressure chambers are annular in shape and said casing **(42)** defines a fluid passage **(416)** for providing fluid communication between said first **(412)** and second **(414)** pressure chambers.

6. A tool as set forth in claim 5 further including a source of pressurized fluid fluidly connected to said fluid passage **(416)** for pressurizing said first **(412)** and second **(414)** pressure chambers.

7. A tool as set forth in claim 6 wherein said fluid passage **(416)** further includes a restrictor orifice **(400)** for restricting fluid flow into and out from said fluid passage **(416)** as said first **(412)** and second **(414)** pressure chambers are compressed in the first and second stages.

8. A tool as set forth in claim 4 wherein said casing **(42)** comprises a power barrel **(52)** and a tool barrel **(50)** fixed to said power barrel **(52)** with said piston **(54)** being slidable in said power barrel **(52)** and said tool bit **(24)** being slidable in said tool barrel **(50)**.

9. A tool as set forth in claim 8 wherein said tool bit **(24)** comprises a bit **(420)** having a head **(422)** and a ram **(426)** separable from said bit **(420)** for impacting said head **(422)** of said bit **(420)** to drive said head **(422)** through said first pressure chamber **(412)**.

10. A tool as set forth in claim 9 wherein said tool barrel **(50)** includes proximal and distal ends and said tool barrel **(50)** defines a bore in said proximal end **(44)** for slidably receiving and supporting said ram **(426)**.

11. A tool as set forth in claim 10 further including an impact chamber between said proximal end of said tool barrel **(50)** and said head **(422)**.

12. A tool as set forth in claim 11 further including a vent port **(436)** defined within said tool barrel **(50)** for preventing a vacuum in said impact chamber when said bit **(42)** is driven distally by said ram **(426)**.

13. A tool as set forth in claim 11 further including a vent port **(438)** defined within said sleeve **(404)** for preventing a vacuum between said sleeve **(404)** and said tool barrel **(50)** as said sleeve **(404)** slides along said tool barrel **(50)** to reduce the energy of said tool bit **(24)**.

14. A tool as set forth in claim 4 wherein said valve **(100, 200)** comprises an exhaust valve **(100)** having a valve housing **(102)** concentrically surrounding said casing **(42)** and a sliding sleeve **(108)** for sliding between said casing **(42)** and said valve housing **(102)** to expose ports **(110)** defined annularly about said casing **(42)** and release pressurized fluid within said chamber **(48)** to atmosphere.

15. A tool as set forth in claim 14 wherein said valve system **(100, 200)** further comprises a pilot valve **(200)** having a valve housing **(202)** and a plunger **(206)** slidable within said valve housing **(202)** for selectively introducing pressurized fluid into and out from said chamber **(48)** by controlling said exhaust valve **(100)**.

16. A tool as set forth in claim 15 further including a bleeder valve **(300)** for assisting the return of said piston **(54)** to an un-actuated position within said chamber **(48)** after said tool bit **(24)** impacts the workpiece **(22)** by bleeding pressurized fluid within said chamber **(48)** proximally of said piston **(54)** to the atmosphere after actuation.

17. A tool as set forth in claim 16 further including a shock absorbing valve **(500)** having two seal rings **(504)** spaced from one another and concentrically fixed to said casing **(42)** and a floating collar **(502)** slidably and concentrically coupled to said casing **(42)** between said seal rings **(504)** to define first **(506)** and second **(508)** annular envelopes whereby said annular envelopes **(506, 508)** selectively pressurize and de-pressurize to reduce recoil shock of the tool **(20)** as said floating collar **(502)** slides on said casing **(42)** between said seal rings **(504)** when said tool **(20)** recoils.

18. A tool as set forth in claim 17 further including an outer casing **(56)** surrounding said casing **(42)** and sealably defining a reserve chamber **(58)** therebetween for holding pressurized fluid.

19. A tool as set forth in claim 18 further including a pressure reducing check valve **(600)** for reducing the pressure of fluid entering into said reserve chamber.

20. A pneumatic tool **(20)** for impacting a workpiece **(22)**, comprising;

a casing **(42)** defining a chamber **(48)**,

a piston **(54)** slidable within said chamber **(48)** along an operational axis **(A)**,

an exhaust valve **(100)** for selectively introducing and releasing pressurized fluid into and out from said chamber **(48)** to slide said piston **(54)** within said chamber **(48)** along said operational axis **(A)**,

a pilot valve **(200)** for controlling said exhaust valve **(200)**,

a tool bit **(24)** independent of and separable from said piston **(54)** and slidable within said chamber **(48)** for receiving an impact from said piston **(54)** thereby driving said tool bit **(24)** into the workpiece **(22)**,

an energy absorbing mechanism **(402)** including a sleeve **(404)** slidable along said casing **(42)** for reducing the kinetic energy of said tool bit **(24)**,

said energy absorbing mechanism further comprising a first pressure chamber **(412)** defined between said tool bit **(24)** and said sleeve **(404)** and a second pressure chamber **(414)** defined between said casing **(42)** and said sleeve **(404)** to reduce the kinetic energy of said tool bit **(24)** in first and second stages by compressing pressurized fluid in said pressure chambers **(412, 414)**, and

a restrictor orifice **(400)** in fluid communication with both of said pressure chambers **(412, 414)** for slowly releasing fluid from each of said pressure chambers **(412, 414)** as the pressurized fluid in each of said pressure chambers **(412, 414)** is compressed in the first and second stages.